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Relativistic dust grains: a new subject of research with orbital fluorescence detectors

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TUS (Tracking Ultraviolet Set-up) was the world's first orbital detector of ultra-high-energy cosmic rays (UHECRs), that was launched into orbit on 28th April 2016 as a part of the scientific payload of the Lomonosov satellite. During TUS operation for 1.5 years, its exposure reached ~1200-1400 km^2sr yr and the detector measured almost 80 thousands events with a few of them satisfying conditions anticipated for extensive air showers (EASs) initiated by UHECRs. A detailed analysis of these events, of event TUS161003 in particular, revealed certain specific features such as an extremely high energy (1 ZeV) and a small slant depth of the shower maximum. These parameters are not compatible with the UHECR spectrum and expected EAS parameters obtained by ground-based experiments, which presents a puzzle for their explanation. From the other hand, relativistic dust grains (RDGs) suggest an interesting explanation of an extreme-energy event developing high in the atmosphere. They were considered long ago by Spitzer and later by Hayakawa as possible sources of UHECRs of the highest energy. According to simulations, an EAS initiated by a massive RDG develops in the atmosphere at slant depths less than 400 g/cm^2. We study if an EAS initiated by an RDG can explain TUS161003 and other similar events and discuss perspectives of their registration with the future orbital missions.

Keywords

ultra-high-energy cosmic rays, relativistic dust grains

Collaboration

other Collaboration

Subcategory

Experimental Results

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